# ARF460A/B

# Datasheet

# RF Power MOSFET

Final

May 2018

Microsemi

Power Matters.™

# Contents

# 1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

## 1.1 Revision F

Revision F was published in May 2018. The following is a summary of the changes in revision F of this document.

- Updated Product Overview (see page 2) image and features bullet
- Added Thermal and Mechanical Characteristics (see page 3) section
- Updated Maximum Transient Thermal Impedance (see page 5) graph
- Updated Capacitance vs. Drain-to-Source Voltage (see page 6) graph
- Updated Threshold Voltage vs. Temperature (see page 6) graph

## 1.2 Revision E

Revision E was published in October 2007. The following is a summary of the changes in revision E of this document.

- Updated to Microsemi format
- Changed operating and storage junction temperature range from –55 °C to 175 °C to –55 °C to 150 ° C
- Changed the GFS (VDS) from 15 V to 25 V
- Changed the minimal values in the Functional Characteristics (see page 4) table

## 1.3 Revision D

Revision D was published in August 2003. The following is a summary of the changes in revision D of this document.

- Updated Maximum Transient Thermal Impedance (see page 5) graph
- Added RC ladder
- Updated patent information

## 1.4 Revision C

Revision C was published in March 2002. The following is a summary of the changes in revision C of this document.

- Updated to remove preliminary status

## 1.5 Revision B

Revision B was published in November 2001. The following is a summary of the changes in revision B of this document.

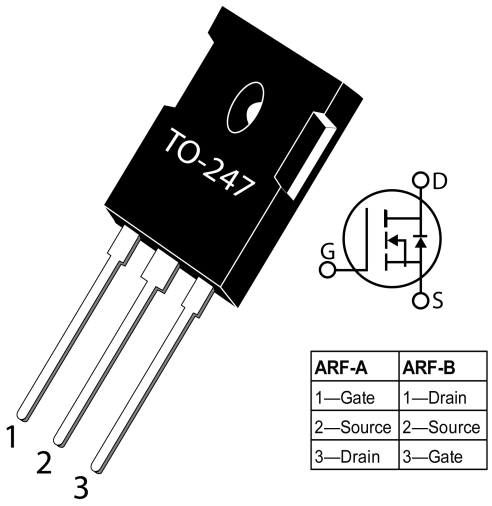
- Updated capacitance values in the Dynamic Electrical Characteristics (see page 4) table

## 1.6 Revision A

Revision A was published in December 2000. It is the first publication of this document.

# 2 Product Overview

The ARF460A and ARF460B comprise a symmetric pair of common source RF power transistors designed for push-pull scientific, commercial, medical, and industrial RF power amplifier applications up to 65 MHz. They have been optimized for both linear and high-efficiency classes of operation.




| ARF-A | ARF-B |
|---|---|
| 1—Gate | 1—Drain |
| 2—Source | 2—Source |
| 3—Drain | 3—Gate |

## 2.1 Features

The following are key features of the ARF460A/B devices:

- Low-cost common source RF package
- Low Vth thermal coefficient
- Low thermal resistance
- Optimized SOA for superior ruggedness
- RoHS compliant

## 2.2 Characteristics

The following are characteristics of the ARF460A/B devices at 125 V and 40.68 MHz:

- Output power: 150 W
- Gain: 13 dB (Class AB)
- Efficiency: 75% (Class C)

# 3 Electrical Specifications

This section details the electrical specifications for the ARF460A/B devices.

## 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the ARF460A/B devices.

All ratings at $T_C$ = 25 °C unless otherwise specified.

**Table 1 • Absolute Maximum Ratings**

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain-source voltage | 500 | V |
| $V_{DGO}$ | Drain-gate voltage | 500 | V |
| $I_D$ | Continuous drain current | 14 | A |
| $V_{GS}$ | Gate-source voltage | ±30 | V |
| $P_D$ | Total power dissipation | 250 | W |
| $R_{\theta JC}$ | Junction-to-case thermal resistance | 0.40 | °C/W |
| $T_J$, $T_{STG}$ | Operating and storage junction temperature range | –55 to 150 | °C |
| $T_L$ | Lead temperature 0.063 inches from case for 10 seconds | 300 | °C |

## 3.2 Thermal and Mechanical Characteristics

The following table shows the thermal and mechanical characteristics of the ARF460A/B device.

**Table 2 • Thermal and Mechanical Characteristics**

| Symbol | Characteristic | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-case thermal resistance | | 0.27 | 0.50 | °C/W |
| $T_J$ | Operating junction temperature | –55 | | 175 | °C |
| $T_{stg}$ | Storage temperature | –55 | | 175 | |
| $T_L$ | Soldering temperature for 10 seconds (1.6 mm from case) | | | 260 | |
| | Mounting torque, 6-32 or M3 screw | | | 10 | lbf-in |
| | | | | 1.1 | N-m |
| WT | Package weight | | 0.22 | | oz |
| | | | 6.1 | | g |

## 3.3 Electrical Performance

The following table shows the static electrical characteristics of the ARF460A/B devices. These devices are sensitive to electrostatic discharge. Proper handling procedures should be followed.

**Table 3 • Static Electrical Characteristics**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-source breakdown voltage ($V_{GS}$ = 0 V, $I_D$ = 250 µA) | 500 | | | V |
| $V_{DS(ON)}$ | On-state drain voltage($I_{D(ON)}$ = 7 A, $V_{GS}$ = 10 V) | | | 4 | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{DS}$ = $V_{DSS}$, $V_{GS}$ = 0 V) | | | 25 | µA |
| | Zero gate voltage drain current ($V_{DS}$ = 0.8 $V_{DSS}$, $V_{GS}$ = 0 V, $T_C$ = 125 °C) | | | 250 | |
| $I_{GSS}$ | Gate-source leakage current ($V_{DS}$ = ±30 V, $V_{DS}$ = 0 V) | | | ±100 | nA |
| $g_{FS}$ | Forward transconductance ($V_{DS}$ = 25 V, $I_D$ = 7 A) | 3.3 | 5.5 | 8 | mhos |
| $V_{GS(TH)}$ | Gate threshold voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 50 mA) | 3 | | 5 | V |

The following table shows the dynamic electrical characteristics of the ARF460A/B devices.

**Table 4 • Dynamic Electrical Characteristics**

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{ISS}$ | Input capacitance | $V_{GS}$ = 0 V<br>$V_{DS}$ = 150 V<br>f = 1 MHz | | 1200 | 1400 | pF |
| $C_{OSS}$ | Output capacitance | | | 150 | 180 | |
| $C_{RSS}$ | Reverse transfer capacitance | | | 60 | 75 | |
| $t_{D(ON)}$ | Turn-on delay time | $V_{GS}$ = 15 V<br>$V_{DD}$ = 0.5 $V_{DSS}$<br>$I_D$ = $I_{D[Cont.]}$ at 25 °C<br>$R_G$ = 1.6 Ω | | 7 | | ns |
| $t_R$ | Rise time | | | 6 | | |
| $t_{D(OFF)}$ | Turn-off delay time | | | 20 | | |
| $t_F$ | Fall time | | | 4.0 | 7 | |

The following table shows the functional characteristics of the ARF460A/B devices.

**Table 5 • Functional Characteristics**

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $G_{PS}$ | Common source amplifier power gain | f = 40.68 MHz<br>$I_{DQ}$ = 50 mA<br>$V_{DD}$ = 125 V<br>$P_{OUT}$ = 150 W | 13 | 15 | | dB |
| η | Drain efficiency | | 70 | 75 | | % |
| Ψ | Electrical ruggedness VSWR 10:1 | | No degradation in output power | | | |

**Note**: Pulse test: pulse width < 380 µs; duty cycle < 2%

## 3.4 Typical Performance Curves

This section shows the typical performance curves for the ARF460A/B devices.

**Figure 1 • Maximum Transient Thermal Impedance**

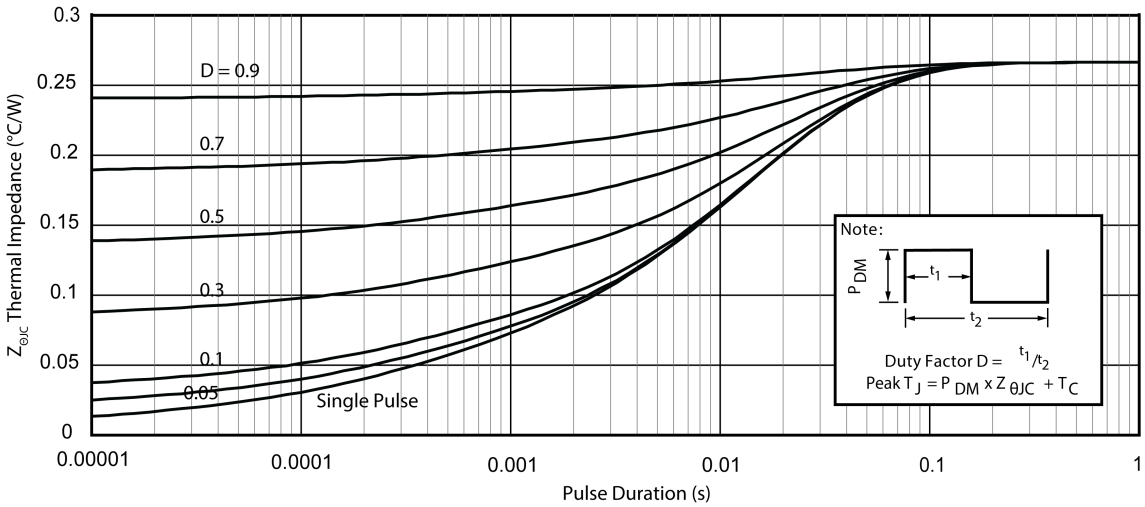



**Figure 2 • Transient Thermal Impedance Model**

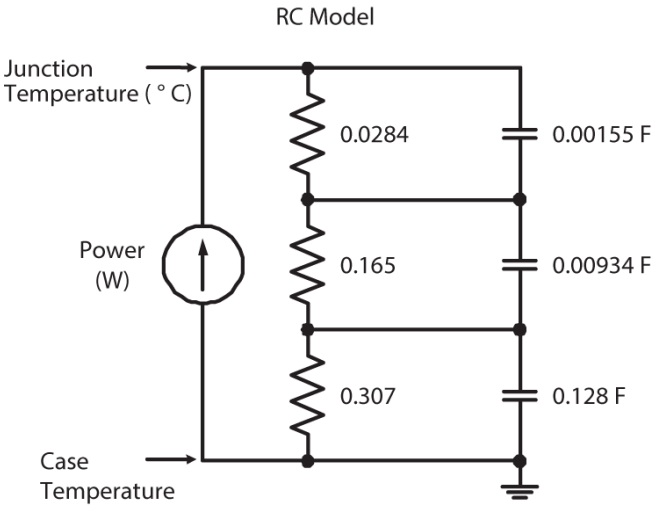


**Figure 3 • Capacitance vs. Drain-to-Source Voltage**

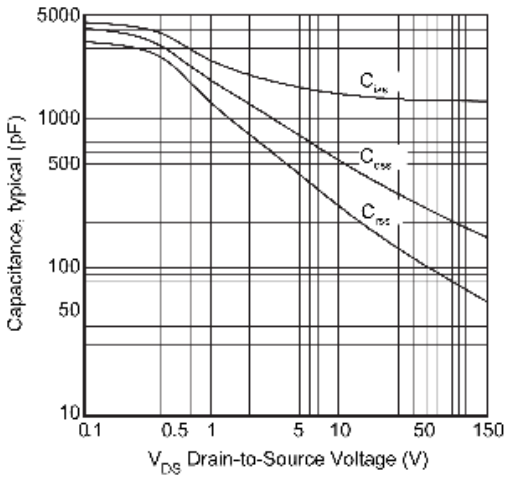



**Figure 4 • Drain Current vs. Gate-to-Source Voltage**

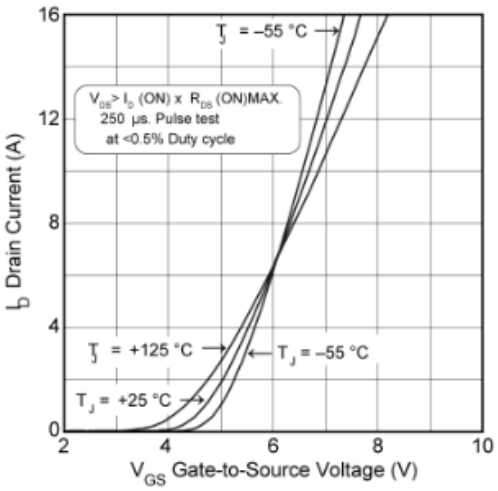



**Figure 5 • Drain Current vs. Drain-to-Source Voltage**

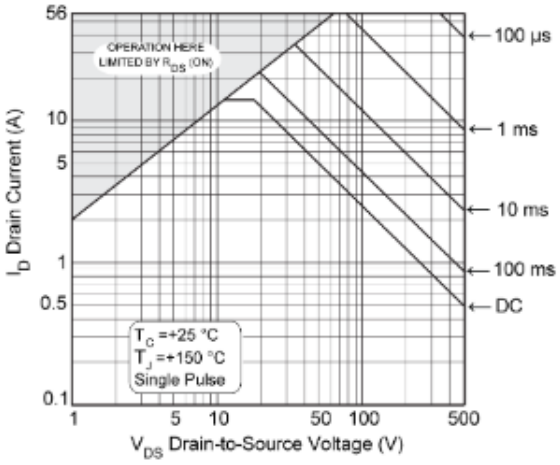



**Figure 6 • Threshold Voltage vs. Temperature**

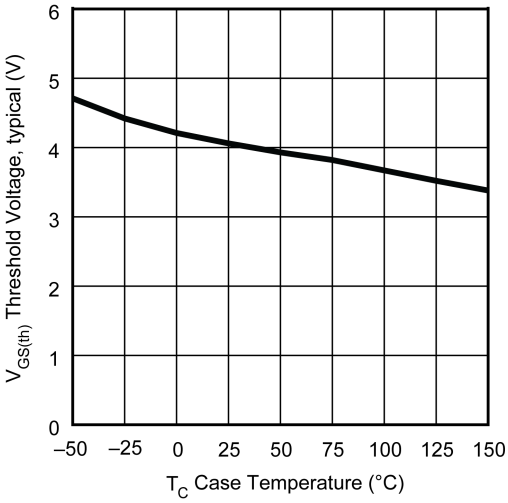
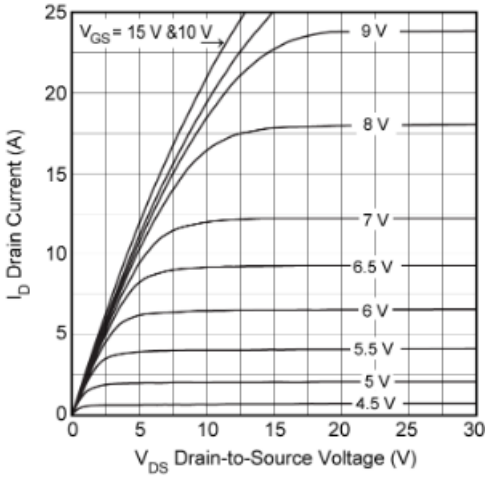



**Figure 7 • Typical Output Characteristics**



The following table shows the typical class AB large signal input and output impedance of the ARF460A/B devices, where $I_{DQ}$ = 100 mA.

**Table 6 • Typical Class AB Large Signal Input—Output Impedance**

| Frequency (MHz) | $Z_{IN}$[1] (Ω) | $Z_{OL}$[2] (Ω) |
|---|---|---|
| 2.0 | 20.9 - j 9.2 | 38 - j 2.6 |
| 13.5 | 2.4 - j 6.8 | 31 - j 14 |
| 27 | 0.57 - j 2.6 | 19.6 - j 17.6 |
| 40 | 0.31 - j 0.5 | 12.5 - j 15.8 |
| 65 | 0.44 - j 1.9 | 6.0 - j 10.5 |

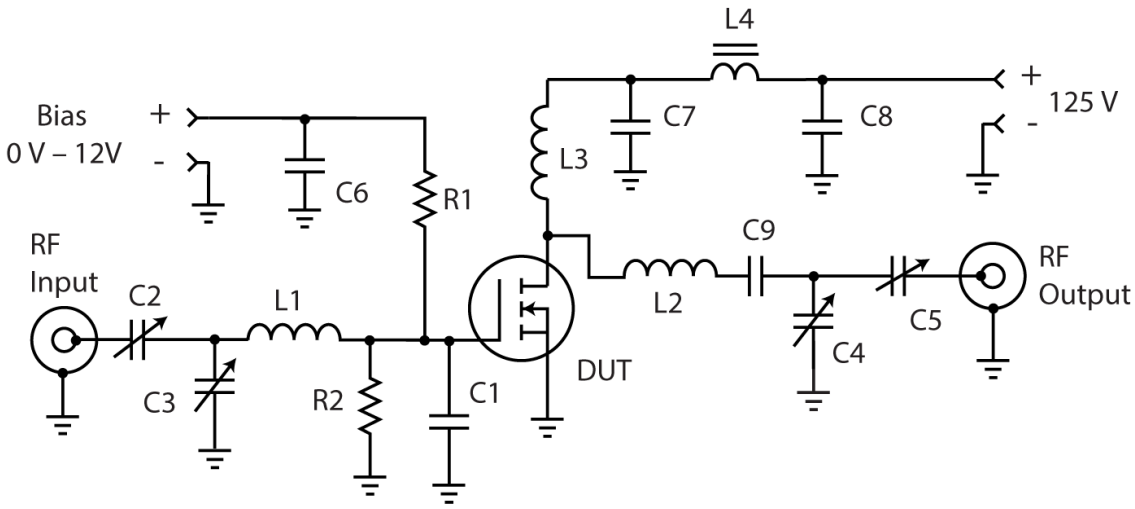
**Note**:

1. Gate shunted with 25 Ω
2. $I_{DQ}$ = 100 mA
3. Conjugate of optimum load for 150 W output at $V_{DD}$ = 125 V

## 3.5 Typical Test Circuit

The following drawing shows the test circuit of the ARF460A/B devices.

**Figure 8 • 40.68 MHz Test Circuit**




The following table shows the test circuit characteristics of the ARF460A/B devices.

**Table 7 • Test Circuit Characteristics**

| Component | Characteristic |
|---|---|
| C1 | 2000 pF 100 V NPO chip mounted at gate lead |
| C2–C5 | Arco 463 Mica trimmer |
| C6–C8 | 0.1 µF 500 V ceramic chip |
| C9 | 2200 pF 500 V chip |
| L1 | 4t #20 AWG 0.25" ID 0.3" L approximately 80 nH |
| L2 | 6t #16 AWG 0.312" ID 0.4" L approximately 185 nH |
| L3 | 15t #24 AWG 0.25" ID approximately 0.85 µH |
| L4 | VK200-4B ferrite choke 3 µH |
| R1–R2 | 51 Ω 0.5 W carbon |
| DUT | ARF460A/B |

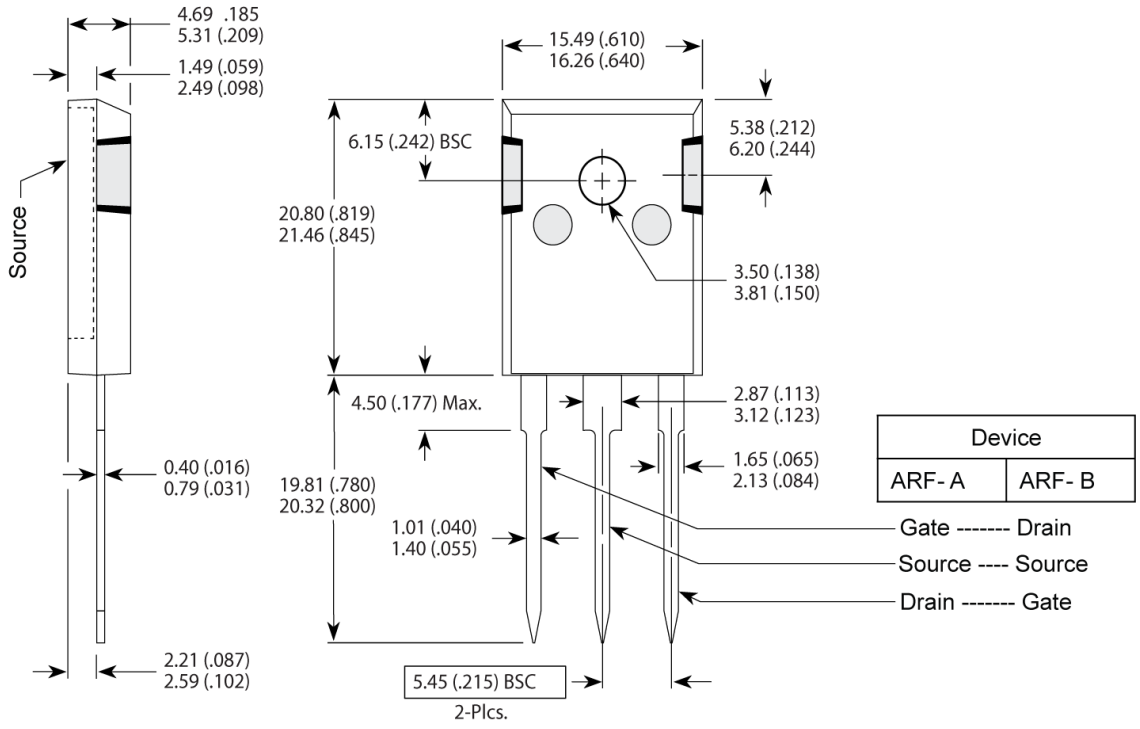
# 4 Package Specification

This section outlines the package specification for the ARF460A/B device.

## 4.1 Package Outline Drawing

This section details the TO-247 package drawing of the ARF460A/B device. Dimensions are in millimeters and (inches).

**Figure 9 • Package Outline Drawing**



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